

Reliability of natural head position in orthodontic diagnosis: A cephalometric study

NAVEEN BANSAL, JEETINDER SINGLA, GURMEET GERA, MONIKA GUPTA¹, GURPREET KAUR

Abstract

Natural head position is a standardized and reproducible position, of the head in an upright posture, the eyes focused on a point in the distance at eye level, which implies that the visual axis is horizontal. While natural head position is a standardized position, natural head posture is a physiologic position of the head, when taking the first step forward from the standing to a moving or walking posture. "Orthoposition" is characteristic for a person and reproducible, but differs among persons. Cephalometrics is constantly undergoing refinements in its techniques and analyses to improve the clinical applications. NHP, a long-proposed modification, yet not fully into practice, can be an "ideal" reference for us to improve our cephalometric interpretation. This study was done to investigate sexual difference in the data obtained, from the study between male and female subjects and to compare the data given in 10-measurement cephalometric analysis based on natural head position, with the data obtained from the present study.

Keywords: Cephalometrics, landmarks, natural head position, true horizontal, true vertical

Introduction

Roentgenographic cephalometry was first introduced to the orthodontic specialty by Broadbent in 1931.^[1] It was first developed as a tool to study cranio-facial growth and development. Gradually it was used to study facial forms, development of norms and assessment of treatment prognosis and growth prediction for the individual patients.^[2,3] Various cephalometric analysis have been evolved in an attempt to define the skeletal characteristics of a "good face" and a "good occlusion," in a precise and easy way^[4].

A number of investigators noticed the variation of the cranio-facial morphology, in different ethnic groups. Most of the investigators have concluded that normal measurements of one ethnic group cannot be considered normal for other ethnic groups. A different ethnic group must be treated according to their own individual characteristics^[4,5].

These traditional cephalometric analyses use the S-N (sella-

nasion) or FH (Frankfort horizontal) planes as reference planes. A number of investigators have expressed concern about the use of these planes.

Ellis and McNamara have supported the opinion that the position of sella can vary both antero-posteriorly and vertically. Unfortunately, measurement based on the Frankfort horizontal plane do not always correlate with clinical examination. These intracranial reference planes can also vary, over time, within a given individual. Natural head position (NHP) provides the key for meaningful cephalometric analysis because an extracranial reference line is used instead of intracranial reference lines, known to be subject to considerable biological variation in their inclination.

The concept of NHP was introduced in orthodontics in the 1950s by Downs (1956), Bjerin (1957), and Moorrees and Kean (1958). NHP has been found to be highly reproducible in adults and children, males and females, Caucasians and non-Caucasians, with a variance of only about 4°. Analysis based on NHP and the true horizontal should have a greater clinical application than traditional methods in describing morphology^[6].

Natural head position is a standardized position of the head in a space when one is focusing at a distant point at eye level.


Natural head posture is the attitude of the head and face in which the patient predominantly lives and which he or she presents to the world.

But it is not necessary all the time that physiologic position will be the normal one.

Natural head orientation is defined as the head position estimated by a trained clinician as the natural one.

Department of Orthodontics and Dentofacial Orthopedics, GIDSR, Ferozepur; ¹Department of Pedodontics and Preventive Dentistry, DAVDC, Yamuna Nagar, Haryana, India

Correspondence: Dr. Naveen Bansal, Department of Orthodontics and Dentofacial Orthopedics, Genesis Institute of Dental Sciences and Research, Ferozepur – 152 001, Punjab, India.
E-mail: naveenortho@yahoo.com

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Aims and Objectives

1. To investigate the sexual difference in the data obtained, from the study between male and female subjects.
2. To compare the data given in 10-measurement cephalometric analysis based on natural head position, with the data obtained from the present study.

Materials and Methods

Lateral cephalograms of 60 adults (30 males and 30 females) were collected. The age range of samples was between 17 and 28 years.

Criteria for the selection of the sample

The subjects were selected for the present study based on the following criteria:

1. They were in the age group of 17-28 years.
2. All exhibited class I occlusion with acceptable profile.
3. Full complement of permanent teeth in proper intercuspation (with a possible exception of the third molars).
4. There was absence of remarkably large overjet and overbite.
5. There was negligible crowding and rotations present in some subjects.
6. They had no history of orthodontic treatment,

orthognathic or plastic surgery treatment.

Method of obtaining the lateral cephalogram in natural head position

The subject was asked to stand below the raised cephalostat with feet at a comfortable distance apart and slightly diverging [Figure 1].

The subject was asked to look into the reflection of the subject's own eyes in the mirror, located on the wall facing the cephalostat at a distance of 5 feet [Figure 2].

The midsagittal plane was aligned in line with the chain plumb line hung by a hook with a metal weight attached to the chain at its free end.

The cephalostat was then brought down into position and locked.

Both the ear rods were then lightly placed into the external auditory meatus of the subject. This ensures the stability of the transverse plane [Figure 2].

The Nasion holder of cephalostat was gently placed on the bridge of the nose to stabilize the head in the vertical plane.

Table 1: Comparison of mean cephalometric measurements between male and female subjects

Measurement	Males		Females		Difference	T value	P value	Statistical inference
	Mean	SD	Mean	SD				
NA-TH	90.70	2.80	91.10	3.10	0.40	0.510	0.610	NS
ANB	1.90	1.20	2.60	1.50	0.70	1.880	0.070	NS
NP-TH	90.00	2.90	89.70	2.30	0.30	0.340	0.730	NS
ANS/PNS-TH	-0.30	4.00	-1.20	4.00	0.90	0.870	0.390	NS
Go-Gn-TH	16.90	3.80	19.30	2.80	2.40	2.740	0.010	S
OP-TH	2.70	3.20	4.50	3.10	1.80	2.200	0.030	S
U1-ANS/PNS	116.80	4.30	114.80	5.30	2.00	1.580	0.120	NS
L1-Go-Gn	103.80	5.50	104.60	6.20	0.80	0.520	0.600	NS
SLINE-V LINE	-13.70	4.60	-13.50	2.80	0.20	0.200	0.840	NS
GLSN-SNM'	1:1.05	1:0.86	1:0.98	1:1.08	-	2.40	0.02	S

Table 2: Comparison of values of 10-measurement cephalometric analysis and present study (male and female subjects)

Measurement	10-Measurement cephalometric analysis Mean \pm SD	Present study	
		Male mean \pm SD	Female mean \pm SD
NA-TH	90 ⁰ \pm 3 ⁰	90.7 ⁰ \pm 2.8 ⁰	91.1 ⁰ \pm 3.1 ⁰
ANB	2.5 ⁰ \pm 1.5 ⁰	1.9 ⁰ \pm 1.2 ⁰	2.6 ⁰ \pm 1.5 ⁰
NP-TH	87.5 ⁰ \pm 2.5 ⁰	90 ⁰ \pm 2.9 ⁰	89.7 ⁰ \pm 2.3 ⁰
GOGN-TH	24 ⁰ \pm 4 ⁰	16.9 ⁰ \pm 3.8 ⁰	19.3 ⁰ \pm 2.8 ⁰
U1-ANS/PNS	108.5 ⁰ \pm 5 ⁰	116.8 ⁰ \pm 4.3 ⁰	114.8 ⁰ \pm 5.3 ⁰
L1-GOGN	90.5 ⁰ \pm 6 ⁰	103.8 ⁰ \pm 5.5 ⁰	104.6 ⁰ \pm 6.2 ⁰
S LINE-V LINE	-12.5 ⁰ \pm 4 ⁰	-13.7 ⁰ \pm 4.6 ⁰	-13.5 ⁰ \pm 2.8 ⁰
Glsn:SnM'	1:1	1:1.05	1:0.98

The vertical plane and horizontal alignment of the film cassette was checked.

The subjects were then asked to swallow and bite into centric occlusion with lips in the relaxed position.

Measurements used in the study

- *Skeletal*: [Figure 3]
 - NA-TH
 - ANB
 - NP-TH
 - ANS/PNS-TH
 - GoGn-TH
- *Dental*
 - OP-TH
 - U1-ANS/PNS
 - L1-GoGn
- *Soft tissue*
 - S line -V line
 - GISn: SnM'

Results

Skeletal measurements

The mean *NA-TH* for males is $90.7^\circ \pm 2.8^\circ$ with a range from 82° to 96° and for the [Figures 4-7] females is $91.1^\circ \pm 3.1^\circ$ with a range from 86° to 98.5° .

The mean *ANB* for males is $1.9^\circ \pm 1.2^\circ$ with a range from 0° to 5° and for the females is $2.6^\circ \pm 1.5^\circ$ with a range from -1° to 5° .

The mean *NP-TH* for males is $90^\circ \pm 2.9^\circ$ with a range from 82° to 96° and for the females is $89.7^\circ \pm 2.3^\circ$ with a range from 86° to 95° .

The mean *ANS/PNS-TH* for males is $-0.3^\circ \pm 4^\circ$ with a range from -5° to 13° and for females is $-1.2^\circ \pm 4^\circ$ with a range from -10° to 5.5° .

The mean *GoGn-TH* for males is $16.9^\circ \pm 3.8^\circ$ with a range from 9° to 24.5° and for females is $19.3^\circ \pm 2.8^\circ$ with a range from 14° to 25° .

Dental measurements

The mean *OP-TH* for males is $2.7^\circ \pm 3.2^\circ$ with a range from -4° to 8° and for females is $4.5^\circ \pm 3.1^\circ$ with a range from -2° to 11° .

The mean *U1 - ANS/PNS* for males is $116.8^\circ \pm 4.3^\circ$ with a range from 108° to 127° and for females is $114.8^\circ \pm 5.3^\circ$ with a range from 103° to 123° .

The mean *L1-GoGn* for males is $103.8^\circ \pm 5.5^\circ$ with a range from 93° to 116° and for females is $104.6^\circ \pm 6.2^\circ$ with a range from 92° to 117° .

Soft tissue measurements

The mean *S line-V line* for males is $-13.7^\circ \pm 4.6^\circ$ with a range from -24° to -4° and for females is $-13.5^\circ \pm 2.8^\circ$ with a range from -18° to -7.5° .

The mean *GISn: SnM'* for males is 1:1.05 with a range from

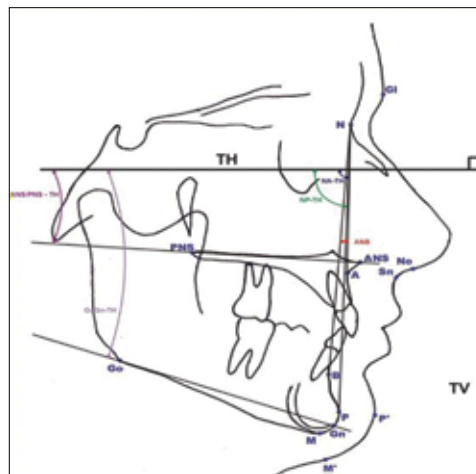


Figure 1: Tracings on cephalogram

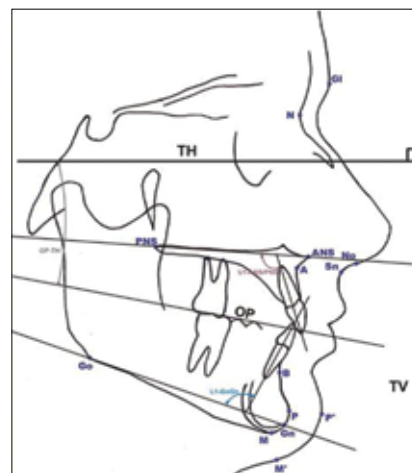


Figure 2: Tracings of hard tissue

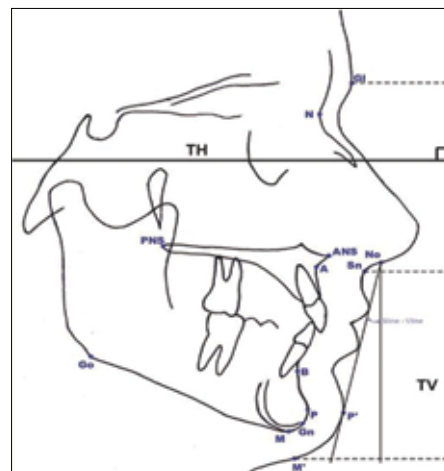


Figure 3: Tracings of soft tissue

1:1.07 to 1:1.12 and for females is 1:0.98 with a range from 1:1.02 to 1:0.93.

Discussion

Skeletal measurements

Most of the measurements are showing no significant statistical difference between the findings of male and female subjects except *GoGn-TH*. Females are showing higher values than male values.

Dental measurements

The dental measurements are showing no statistical significant difference between male and female values except the *OP-TH* value. Females are showing occlusal plane tipped more downward anteriorly.

Soft tissue measurements

Out of two soft tissue measurements, linear measurement ratio (*GISn:SnM'*) is found to be statistically significant between male and female values, while other is insignificant. Females are showing decreased lower anterior facial height as compared to males.

When the standard values of 10-measurement cephalometric analysis is compared with the values obtained in the present study for males and females, following differences were found:

1. Collected sample has lower mandibular plane angle.
2. Collected sample has more proclined upper and lower incisors.

In the present study variation is found in the Inclination of occlusal plane and palatal Plane in relation to TH.

When OP and PP are tipped downward anteriorly that means when angles are formed posteriorly with TH it is considered a positive value.

When OP and PP are tipped upward anteriorly that means when angles are formed anteriorly with TH it is considered a negative value.

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